Learning perceptual aspects of diagnosis in medicine via eye movement modeling examples on patient video cases

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Eye Movement Modeling Examples in Medical Education

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Attentional Guidance during Learning

Complex tasks with a **dynamic** and **visually rich** component, like stating a diagnosis based on motion patterns (semiological diagnosis of ictal behavior, e.g., Dreifuss & Nordli, 2000), do not only require conceptual knowledge but also **perceptual skills**. These skills enable a person to distinguish between irrelevant and relevant information and to focus on the latter.

However, **prior studies** (Balslev et al., in prep.; Jarodzka, Scheiter, Gerjets, & Van Gog, 2010) revealed that compared to experts **novices have difficulties** in performing respective tasks. For instance, they look at irrelevant features, describe too few relevant areas, and cannot interpret their observations accurately.

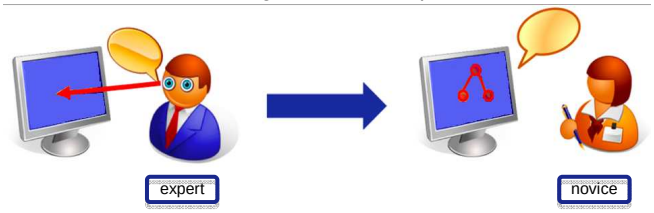
The goal of the current study was to support novices in performing these tasks by **providing attentional guidance** to them. This guidance was designed based on **modeling** (Collins, Brown, & Newman, 1989) and process-oriented **worked examples** (Van Gog, Paas, & Van Merriënboer, 2004).

Method

Development of the Attentional Guidance

1st Step: An expert performed a diagnosis by describing aloud the motion patterns of four infants shown to him on videos. During task performance the expert's eye movements were recorded.

2nd Step: The expert's eye movements and verbal descriptions were superimposed onto the videos. These augmented videos served as **Eye Movement Modeling Examples** (Van Gog, Jarodzka, Scheiter, Gerjets, & Paas, 2009) to teach to novices how to diagnose epileptic seizures in infants according to their motion patterns.



Procedure

60 **medical students** (age: *M* = 26.57 years, *SD* = 2.03; 41 females)

Design: No attentional guidance vs. attentional guidance as circle vs. attentional guidance as spotlight

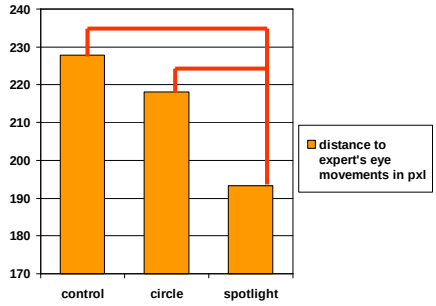
Control | Circle | Spotlight

Learning Phase: All groups received four videos depicting potentially diseased infants whereby, the experts' spoken descriptions of the motion were identical across groups. Depending on experimental condition, the videos included either superimposed expert eye movements as circle or as spotlight.

Testing Phase: Six **novel** videos depicting potentially diseased infants had to be diagnosed according to their motion pattern (measured via a multiple choice questionnaire).

Results

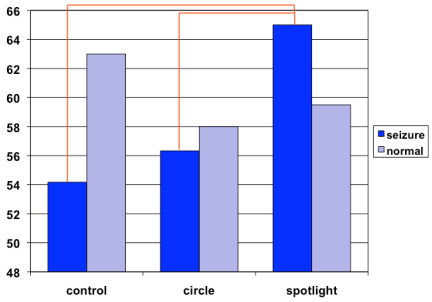
Attention guidance: $F(2, 57) = 10.32$, $p < .01$; Post hoc: Spotlight differs from both other groups significantly ($p < .01$)



Correctness of description (in %):

of epileptic seizure: $F(2, 57) = 9.13$, $p < .01$; Post hoc: Spotlight differs from both other groups significantly ($p < .01$).

of normal behaviour: $F < 1$.



Discussion

Attention guidance based on expert's eye movements in video-based modeling examples fosters learning of diagnosis. Participants in the spotlight group outperformed the control and the circle display group in diagnosing epileptic seizures based on patients' motion patterns. No differences were found in diagnosing normal behaviour.

Two questions for future research:

(1) Why did both **types of eye movement displays** resulted in such differential effects?

Does presenting expert's eye movements as additional information (i.e., circle) overwhelm students, while presenting expert's eye movements by reducing information (i.e., spotlight) frees their working memory capacities?

(2) Why does this effect occur for diagnosing seizures, but not for diagnosing the **differential diagnosis**?

Does describing a differential diagnosis rely more on conceptual knowledge – not varied in the current study – than perceptual skills?

References

Collins, A., Brown, J. S. & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction* (pp. 453-494). Hillsdale, NJ: Erlbaum.

Balslev, T., Jarodzka, H., Holmqvist, K., Grave, W. S. de, Muijtjens, A., Eika, B., et al. (in preparation). How do paediatricians do it? The influence of experience and training on attention and clinical reasoning.

Dreifuss, F. E., & Nordli, D. (2000). Classification of epilepsy in childhood. In J. M. Pellock, W. E. Dodson, & B. F. D. Bourgeois (Eds.), *Pediatric epilepdy: Diagnosis and therapy* (p. 69-80). New York : Demos Medical Publishing.

Jarodzka, H., Scheiter, K., Gerjets, P., & Van Gog, T. (2010). In the eyes of the beholder: How experts and novices interpret dynamic stimuli. *Learning and Instruction, 20,* 146-154.

Van Gog, T., Jarodzka, H., Scheiter, K., Gerjets, P., & Paas, F. (2009). Attention guidance during example study via the model's eye movements. *Computers in Human Behavior, 25,* 785-791.

Van Gog, T., Paas, F., & Van Merrënboer, J. J. G., (2004). Process-oriented worked examples: Improving transfer performance through enhanced understanding. Instructional Science, 32, 83-98.